# Mortgage Loan Insurance

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# I. Introduction

The purpose of this report is to discuss some aspects of mortgage insurance in Canada. In particular, the report comments on some of the issues raised in the Mortgage Loan Insurance Assessment Report (1984) prepared by the Program Evaluation Division of CMHC. A summary of the major issues raised in the Assessment Report is contained in Schedule A of a letter dated July 31, 1984 from CMHC to the present writer.

In preparing the present report, I have concentrated on issues which seemed to me to be important and where I felt equipped to make a useful contribution. Thus this report is written from the perspective of someone with a background in insurance, actuarial science and modern financial economics.

Recently economic theorists have made considerable progress in constructing models involving risk sharing under conditions of informational asymmetry. In certain insurance markets some of the consequences of these asymmetries have been known for a very long time and dealt with by explicit contract design. The point is that the pure risk sharing function of insurance can be interferred with if the parties to the contract do not have the correct incentives. Contract design can modify incentives and the present report emphasizes the importance of incentives.

The next section of my report discusses some of the problems caused by informational asymmetries in insurance markets in general and relates them to the specific case of mortgage loan insurance. There is also a discussion of the general nature of the mortgage default risk.

Section 3 examines the theoretical and empirical literature on the determinants of the default risk. It is helpful to classify the factors affecting the risk into micro-factors and macro-factors. The risk sensitivities with respect to some of these factors is influenced by mortgage design and certain economic variables so that naive extrapolation is dangerous. The premiums to be charged for mortgage insurance are influenced by the relevant risk factors and, I argue, the structure of the risk-sharing arrangement under the contract. Section 4 discusses two approaches to the problem of premium determination and comments on some of their strengths and weaknesses.

Section 5 discusses the problem of risk management of a mortgage insurer at the portfolio level. Two specific techniques for liability risk management at the portfolio level are discussed. The report suggests that imaginative procedures are available or could be made available for active risk management through strategic investment management. There is scope here for CMHC to stimulate the introduction of new financial instruments.

The final section outlines a possible scenario for the evolution of private and public mortgage insurance in Canada. It is emphasized that some concrete steps would need to be taken to encourage the private sector's involvement in this area. The Economic Council of Canada in its recent report entitled "Intervention and Efficiency" stated:

> "We recommend that the Canada Mortgage and Housing Corporation gradually withdraw from the direct insurance area and offer mortgage reinsurance instead. We further recommend that the premiums charged differentiate between classes of risk and they be established at a level that covers the costs of operation and maintains a sound level of reserves."

While much of my report is consistent with this recommendation, I concentrate on some of the difficulties faced by prospective and existing private insurers in this market. There are some suggestions as to how these difficulties might be overcome.

As mentioned earlier, my report only deals with certain aspects of the issues raised by the Assessment Report. I have benefitted from discussions with a number of individuals in both the United States and Canada in preparing this report. In particular, I wish to thank Mr. David C. Toms who was very generous with his time, ideas and expertise.

## 2. Background Concepts and Analysis of Mortgage Loan Insurance

The purpose of this section is to provide a background discussion of some of the issues and concepts that will prove helpful in our subsequent analysis of mortgage insurance.

The insurance mechanism has evolved as a convenient method of dealing with risk. By pooling a large number of independent risks, it is possible for each individual to engage in risk sharing. Thus in life insurance each policy-holder pays a premium based on his probability of survival and the accumulated premiums are used to pay whatever claims arise. Sometimes events can happen which affect the probabilities of death of an entire group or country such as a war. Insurance companies tend to include clauses in their contracts which limit their exposure under these circumstances. In general, we find well functioning insurance markets where the risks involved are independent.

There are other risks often termed fundamental risks which are of economic, political or social origin. These risks tend to affect broad groups of individuals at the same time. Examples of such risks would be economy-wide unemployment or a natural disaster such as an earthquake affecting an entire region. In these cases the independence assumption is violated. Other measures are invoked to handle risks of this nature.

Governments may provide programs to deal with them as is often the case with unemployment. In the case of the earthquake risk government programs are also used. An individual can avoid the risk by moving to an earthquake-free zone or lessen its potential impact by appropriate building design. For these types of risks private insurance is not usually an appropriate mechanism.

Between these two extremes there are risks which have both an independent component and are at the same time influenced by common factors. An example of such a risk would be the risk of long term disability. At first, it might seem as if the incidence of this risk would be independent across individuals and groups. In fact the incidence of claims is strongly related to certain macroeconomic factors such as the rate of unemployment. Nevertheless this risk continues to be underwritten by the private insurance market. However, very careful attention is paid to underwriting, contract design, claims administration, and the provision of appropriate incentives in the design of the contract. The traditional quantitative models for insurance premium calculation dealt with the risk as a random process. The actual design and administrative procedures reflected a keen appreciation of the nonrandom aspects of the risks insured and the potential problems caused by asymmetric information.

It is only relatively recently that economists have realized just how significant the consequences of asymmetric information are in the context of certain markets and have started to construct models which capture this phenomenon. Two particular consequences of asymmetric information are vividly illustrated in an insurance context and have recently become important in the economics literature.

Moral hazard occurs where one of the parties to a risk sharing arrangement can take a private action which is unobservable to the other party and which affects the outcome. Thus in some branches of insurance an individual may be tempted to take an action which would increase the likelihood of his collecting an insurance claim or the actual size of the claim. There are many illustrations in the insurance field of this pervasive phenomenon. One of the most obvious illustrations of this is the so-called principle of idemnity found in most insurance legislation. This states that an insured is not permitted to receive more than the value of the insured asset under an insurance contract. If the premium for complete insurance were $P$ and the asset was worth $A$ then if the risk were purely random there should be no objection to the insured paying $2P$ for coverage of $2A$. In most jurisdictions the maximum amount that can be recovered is $A$. Thus the very existence of insurance can alter the claim distribution.

Depending on the nature of the risk insured different approaches are used to deal with the problem of moral hazard. Some of the remedies are included in the legislation. The contract design can mitigate the impact of moral hazard. This is one of the reasons why deductibles are common in some branches of insurance. Other types of contract design include coinsurance. When the insured is compelled to absorb some of the loss himself this can lead to lower claim incidence rates and reduced claim sizes. Some risks at any rate, can be conceptualized as arising from random factors and also from the insured's own actions. The design of the contract should be such that the insured is motivated to take those actions which will reduce the size of the loss. The motivation can take either the form of a bonus or penalty i.e. either the carrot or stick! An analysis of how the characteristics of the two parties and the nature of the risk involved leads to an efficient contract form is given by Holmstrom (1979). This theoretical analysis confirms what is observed - the provision of appropriate incentives can lead to more efficient contracts.

Whereas moral hazard arises because the actions of a particular insured are not costlessly observable, adverse selection occurs when a standard contract is offered to a group whose probabilities of loss differ. If the individual members of the group have superior knowledge of their own

risk characteristics then even if the contract is fairly priced on the basis of the group as a whole only the high risk individuals will take up the contract and the premiums collected will be inadequate. Insurance companies have developed techniques for dealing with adverse selection. For example in group insurance plans which cover a well defined group such as the employees of a particular corporation, membership of the group insurance plan may be mandatory.

Adverse selection has a number of applications beyond the insurance market. Akerlof (1970) has examined an interesting illustration of this phenomenon in the used car market. Buyers of used cars know only the average quality of cars in the market whereas the seller who has owned the car has more accurate information on the car's quality. Those sellers with above average cars will tend to leave the market and as a result the average quality of the remaining cars will decline. Ultimately this process will lead to the collapse of the market. Akerlof develops a simple model of this phenomenon and discusses some of the remedies that could be used to prevent market failure.

Rothschild and Stiglitz (1976), in an important paper, have analysed the competitive market for insurance in the presence of adverse selection. They showed that equilibrium in such markets can have strange properties and in some cases may not even exist. They consider a situation where there are two types of individuals with different risk

attributes and the same (risk averse) utility function. Assuming that the insurance company cannot distinguish between the two groups, then if it offers one contract, adverse selection will occur and the equilibrium is unstable. Under some circumstances a separating equilibrium may exist. The insurer offers two contracts, one of which attracts the high-risk individuals. This equilibrium may be unstable under certain conditions. The concept of equilibrium can be restored in this market if assumptions are made concerning the reaction of insurance companies to contracts offered by their competitors. Riley (1979) and Wilson (1977) have developed the concept of a reactive equilibrium.

It is worth pointing out that some of the recent social trends and government policies in many countries will exacerbate the problem of adverse selection. In many jurisdictions, insurance companies are prohibited from classifying risks on the basis of certain attributes on the grounds that it would be discriminatory. Thus far some types of automobile insurance companies are no longer allowed to vary their premiums on the basis of age, sex, marital status or place of residence. In the case of pension plans and annuities, there has been considerable discussion concerning the merits of using unisex mortality tables to compute annuity and pension payments. It is a well documented fact that women live longer than men and so the mandated use of a single mortality table can cause serious problems in the annuity market.

The concepts discussed thus far in this section are useful in the analysis of mortgage insurance. They can provide helpful insights into this type of insurance.

Dealing first with the partition of risks into three classes:

(1) risks which are stochastically independent,

(2) risks which are highly correlated,

(3) risks which arise from both independent and highly correlated factors.

It is suggested that the risks associated with mortgage insurance fall into class (3). A more detailed analysis of the determinants of the risk is carried out in Section 3. We find there that these risks are generated by both micro factors and macro factors.

The question of the optimal contract design is very important in the context of mortgage loan insurance. In this case, there are three parties involved, the lender, the borrower, and the insurer. My own intuition is that the current design where the lender has complete insurance coverage is inefficient. A contract which shifted some of the risk to the lender from the insurer via a deductible or some other arrangement would seem to have considerable merit. The borrower under the present system appears to

have little incentive to reduce the size of the loss if a claim occurs. While I have no empirical evidence available, it seems to me the borrower has an incentive to remain in the house rent-free for as long as possible and pay little attention to maintenance or upkeep if the mortgage is in default. A run-down property is much less attractive in the real estate market. In order to induce the borrower to enhance or maintain the value of the property, perhaps the pressure can be most realistically applied through the lender. I understand that the corresponding contracts in the United States contain a provision of this nature. The lender covenants to return the property to the insurer if a claim arises, in the same condition as when the insurance was taken out. Other arrangements with these types of incentive characteristics may be possible.

In this specific connection, it might be useful to survey lender's attitudes in situations where mortgages are in default both with mortgage loan insurance and without mortgage loan insurance. Assuming that representative samples of both were available, even an informal survey should reveal some distinctive differences. This would give useful insights as to what types of measures could be included in a revised contract design. Incorporation of appropriate incentives or conditions should tend to reduce

average claim sizes and lead to more favourable claims experience.

My reading to date in this area and discussions with individuals knowledgeable about the mortgage insurance business indicates that the existence of adverse selection can be a problem here as in other areas of insurance. For example, if lenders have reason to believe that mortgages granted to particular borrowers or in particular locations are risky, then they will insist on insurance even if it is not mandatory. Another example would be when the lender has the option of retaining the property or transferring it to the insurer. Woodward (1959) predicted the likely outcome in these circumstances:

> "...As mentioned, the lenders have a free choice in this regard and it is likely that in the course of time all lenders will tend to transfer to C.M.H.C. only those properties which are not readily saleable at a profit and those which are not considered to be desirable revenue-producing properties."

As far as C.M.H.C. is concerned, lenders no doubt have some influence on which insurer a builder decides upon. The allocation between M.I.C.C. and C.M.H.C. is probably not done on a random basis. Some sort of selection takes place here, but I do not have the necessary information available.

As we have seen, adverse selection can arise whenever one of the parties to the contract has superior knowledge of his own risk characteristics and this information is not revealed to the other party. Similar types of problems could arise if an insurer were prevented from discriminating on the grounds of particular (reliable) risk attributes. Some of the recent human rights legislation (and perhaps the newly adopted Canadian constitution) may exert pressure in this direction. The point is that a movement to a finer partition of risk classes may be in direct conflict with these forces. For example, age, sex, marital status and place of residence may be among the micro factors influencing the risk of default. Bearing in mind the experience of the automobile insurance industry, it is not difficult to imagine the introduction of constraints on the freedom of mortgage insurers to adjust their prices based on these variables. Up to now, both MICC and CMHC have used very broad risk classifications - too broad many would argue. One of the unanticipated consequences of their premium scales is that these insurers are not viewed (as far as I can tell) as being in conflict with the human rights legislation in the various provinces. This particular issue is highlighted here because it might become more of a problem under some revised structure for the mortgage loan insurance industry.

At this juncture, it is helpful to summarise the main points of the present section.

- Risks can be classified into three classes depending on whether they are stochastically independent, perfectly correlated or partly correlated.
- Mortgage insurance falls into the third category. There is a difficulty in dealing with the macro-component of the risk.
- Problems caused by asymmetric information have a profound impact on optimal insurance contract design and the efficient operation of insurance markets.
- Problems arising from moral hazard can be ameliorated by efficient contract design. The optimal contract should provide not only for risk sharing but also the correct incentives.
- Improvements in the current design of the mortgage insurance contract are feasible. Some general suggestions were made.
- Adverse selection is a problem in many lines of insurance. While little published empirical evidence is available, casual investigation indicates it is present in the mortgage loan insurance market.
- To the extent a mortgage insurer refines the risk classification system with respect to the risk attributes of borrowers, the gains in efficiency may be offset by social pressures and the consequences of human rights legislation.

## 3. Determinants of Default Risk

A number of research studies have been carried out to investigate the determinants of default risk. Virtually all these studies have been carried out using United States data. A survey and brief critical analysis of some of the more recent research is given by Campbell and Dietrich (1983). Campbell and Dietrich conclude that default incidence is related to current as well as original loan/value ratios. Default incidence is also related to changes in regional unemployment rates. They also conclude that their results based on the default experience of the 1960's and 1970's provide little basis for entrapolating the future default incidence of alternative mortgages in economies with more volatile inflation and other economic variables.

Swan (1982) in a helpful paper on pricing mortgage insurance divides the risk factors into what he labels micro and macro factors. Micro factors include borrower, loan and maturity characteristics of an individual loan. Examples of such factors would be gross debt service ratio, loan to value ratio, age of borrower, junior financing and type of loan. Macro factors would include items such as interest rate levels, inflation rates and business cycles. As Swan notes, it should be possible to diversify away the risks arising from micro risks by

underwriting a spread of risks. This technique will not be able to remove macro risks.

As far as the actual default decision of borrowers is concerned two competing hypotheses have been discussed (cf. Jackson and Kaserman (1980)). The first, the equity theory of default, is that borrowers default when the gains from default exceed the costs. The second is the ability to pay theory which suggests that borrowers will not default as long as they have sufficient income to meet their periodic mortgage payments. In practice, there may be an interaction of both of these influencing the default decision. Consider one scenario. A homeowner becomes unemployed. He continues making mortgage payments as long as he can. Then having exhausted all income sources he considers using the equity in his home to secure additional funds. If an appraisal indicates that the value of his home lies below the value of the outstanding mortgage the incentives to default increase. The homeowner can if he defaults continue to reside rent free in the property until foreclosure occurs.

In discussing the factors which influence default risk and claim size, it seems ironic that in recent years government actions have sometimes contributed significantly to their increase. Recently the law in Alberta was amended so that lenders no longer have the covenant of the borrower

as additional security on a mortgage. In these circumstances there is a strong temptation for borrowers with the financial capacity to pay, to default. At the Federal level the ill-fated foam-insulation programme severely reduced certain house values and increased the incentive for borrowers to default.

Another important factor which has a bearing on the default incidence is the design of the mortgage instrument. In recent years because of increased interest rate volatility long term fixed interest contracts such as traditional whole life insurance and long term mortgages have become less attractive. The term of mortgage loans has shortened. In addition high and volatile inflation rates have given rise to the so-called tilt problem in the case of a standard level payment mortgage, (cf. Carr and Smith (1983)). Under a level payment mortgage the real percentage of income devoted to mortgage repayments starts high and declines over the term of the loan in an inflationary era. By the same token the equity in the home increases fairly quickly (cf. Intervention and Efficiency (1982), page 165). A variety of new mortgage designs (see Carr and Smith (1983)) have been proposed to address the tilt problem. Under these new designs the initial gross debt service ratios are smaller and the equity build-up in the house is slower. This means that the loan to value ratio remains higher than under a level payment mortgage. Consequently the default incidence

under such instruments should be greater ceteribus paribus. This effect will be accentuated if it is uncompanied by an increase in the volatility of house prices. Statistics of default gleaned from studies of conventional mortgages need to be applied with great care to these newer instruments. It is also possible that given a menu of different mortgage designs borrowers with particular risk characteristics and attributes may go with a different design. As we have seen, this phenomenon is known in the insurance literature as adverse selection. Buyers of annuity contracts have longer life expectancies than the population at large. Actuaries use much heavier mortality tables to compute premiums for life insurance than for annuity contracts.

Adverse selection may also distort the expected relationship between certain risk attributes and default incidence. For examples the higher the initial loan to value ratio the greater is the probability of default other things being equal. This is a result obtained in particular from the option pricing approach discussed in Section 4. However a low loan to value mortgage may be insured because the lender has reason to believe it is a risky loan. There is no mandatory requirement for loans with a loan to value ratio below 75% to be insured. The existence of the insurance may in some cases carry information. It is my understanding the lenders in Canada may insist on insurance

of low ratio loans for other reasons depending on the supply of mortgage funds but published empirical evidence on this does not appear to be readily available. The information revealed by the insurance purchase decision may be illustrated by a somewhat more extreme example from the long term disability insurance area. Individual disability insurance is extremely subject to adverse selection. The following quotation illustrates the view of one insurance company executive [A.E. Jeffries (1979)]:

"There appears to be a class of insured who becomes a claim very quickly, and an underwriter might kick himself for not having spotted a tell-tale sign of incipient trouble. There is one simple underwriting tool which would eliminate self-selection namely to ask the proposer whether he sought the insurance himself or was talked into it. Impracticable though it is it would seem wise to instruct underwriters to decline all proposers seeking this type of insurance without having been 'sold' the cover. I suspect that some adverse selection may be attributable to a group of proposers who are more enthusiastic about this type of insurance than the insurers would like."

It may be worthwhile summarizing the main points of this section.

- Empirical research on the determination of default risk on mortgage loans has been carried out in the United States.

- The risk factors can be divided into micro factors and macro-factors.
- One of the main factors is initial loan to value ratio and its subsequent evolution.
- This evolution depends on the future movements of house prices and the characteristics of the mortgage loan instrument.
- More subtle implications of adverse selection are difficult to determine from the existing empirical data.
- Risk arising from micro type factors can be diversified but other methods of dealing with macro factors are required.

## 4. Premium Determination and Pricing of Mortgage Insurance

In this section, I discuss certain aspects of premium determination. As I have argued elsewhere in this report, the premium is but one of the parameters of the insurance contract. The premium is related to and dependent on the terms and conditions of the contract, the underwriting procedures, the anticipated risk experience and the claim settlement process. The insurance contract in most cases involves risk sharing and incentives. To discuss the premium without prescribing these other items is not very meaningful. Most discussions of premium determination or price determination focus on the influence of the anticipated risk experience assuming a particular type of mortgage loan and current claim administration practices.

In Canada the premiums charged by CMHC (and the private insurers) have remained fixed for long time periods. Furthermore, there are very few distinct risk classes used in Canada in contrast to the United States. Currently it is clear that current premiums are inadequate as both. MICC and CMHC have been incurred very substantial and significant losses in recent years. It is clear from the empirical studies in the previous section that a somewhat finer risk-class division there that used by CMHC could be supported. The Canadian premium structure involves

substantial cross subsidy among different borrowers and is a sign of imperfect competition. In current conditions the first problem is to correct the over-all level of premiums then the issue of risk classes can be addressed.

In Canada the premium for the insurance is paid by the borrower although the insurance protects the lender. The Canadian system is to charge a lump sum premium to the borrower and this premium is added to the loan amount. Until recently the Department of Housing and Urban Development (HUD) in the United States used a different approach. Periodic premiums were charged by increasing the mortgage interest rate. It is my understanding that HUD has now changed to the Canadian system for collecting FHA insurance premiums.

The current premiums for FMA mortgages in the United States are computed using an expected cost approach (private communication, Thomas N. Herzog, Actuarial Division, Office of Financial Management, HUD). A description of a similar procedure is given by Swan (1982) who also discusses the expected cost approach. Swan cautions against the naive extrapolation of historical experience as a basis for the future. Nevertheless, this type of approach seems useful especially if it is supplemented with some form of Bayesian updating. For example, it may be possible to supply a Kalman filter technique to update premiums (cf. Boyle, P.P.

and DeJong, P. (1983), Measuring Mortality - A State Space Approach, Journal of Econometrics, Vol. 23). However, the macro factors referred to in Section are difficult to forecast with accuracy.

More recently financial economists have used option pricing models to determine equilibrium mortgage loan insurance premiums. Smith (1980) has applied this methodology to consider loans in general and mortgage loans in particular. Hendershott and Cunningham (1984) set out a procedure for computing mortgage loan insurance premiums on FHA mortgages using an option pricing framework. Hendershott and Cunningham refer to some of the other related work in this area. There is no doubt that this methodology provides very useful insights into the premium structure for mortgage loan insurance. The insurance contract is viewed as a put option sold by the insurer and purchased by the borrower for the protection of the lender. The initial work in this area simply assumed that the value of the put option upon exercise was (M - H) where M is the current value of the mortgage loan and H is the market value of the house. As we have noted in section 3, this may be a necessary but not always a sufficient condition for default. A more detailed analysis indicates that the value of the option is the difference between the gains from default and the costs of default.

Hendershott and Cunningham (1984) give a more detailed analysis of these gains and costs and incorporate them into the model. Based on their studies these authors conclude that there are wide variations in fair insurance premiums across existing risk classes in the market and that borrowers with low loan to value ratios or rapidly amortising loans subsidize borrowers with high loan to value or negative amortising loans.

The present writer suggests that the option pricing framework provides a very useful tool to investigate premiums for mortgage loan insurance. Like any model it represents an abstraction from reality and some of the simplifications in the present case are worth commenting on. The models used to date assume a log normal diffusion model for house prices. In fact, some of the events triggering house price falls are likely to be discontinuous. The variance of the series of house price returns is especially difficult to estimate and is probably even less stationary than stock price variances. Work by Hoag (1980) has shown that the appraisal process induces a degree of smoothing so that actual historical variances may themselves be underestimates.

The importance of the variance estimates is that the value of an option depends critically on the assumed variance level. There is a considerable range in actual

variance levels through time and across regions as Table 1 indicates.

Table 1: Estimates of Standard Deviations of House Prices

| Location | Time Period | Standard Deviation p.a. % | Source |
|---|---|---|---|
| U.S.A. (FHA) | 1960 - 1980 | 9.0 | Foster & Van Order (1984) |
| Southern California | 1960 - 1967 | 11.9 | Asay (1978) |
| Canada | 1974 - 1982 | | |
| Mississauga (Toronto) | 1974-1982 | 8.1 | Royal Trust Survey (Calculations by present author) |
| Mount Royal (Montreal) | 1974-1982 | 11.7 | |
| Richmond (Vancouver) | 1974-1982 | 21.0 | |
| Calgary | 1974-1982 | 12.4 | |

The insurance contract is modelled as an American put option with an exercise price equal to the value of the outstanding mortgage. The value of this type of put option is very sensitive to the assumed volatility of house prices. It is a difficult task to get good estimates of the future volatilities of house prices. Furthermore these will vary across provinces and within a given province as Table 1 shows.

The option pricing model can be modified to handle different assumptions regarding the future movements of house prices. In the studies published to date, the assumption is that the behaviour of house prices follows the same sort of stochastic process as stock prices. This assumption simplifies the analysis, but it needs more empirical underpinning.

If an option pricing approach is used, and even if the model is appropriate and good estimates of the variance are available, an insurer needs to ensure that there will be enough funds from accumulated premiums to meet the claims as they occur. The appropriate investment strategy to guarantee that claims will be met is not always a feasible one. For a related problem in an insurance context, see Collins (1982).

In summary the main points of this section are:

- Current premiums charged by CMHC and MICC are inadequate. In addition, the premium structure at present reflects imperfect competition and involves substantial cross subsidies.
- There are two main methods of premium calculation - the estimated future cost approach and the option pricing approach.
- The estimated future cost approach projects future costs. These consist of losses due to insurance claims and administrative expenses. These costs are discounted to obtain a present value. This represents the traditional actuarial approach.

## 5. Active Risk Management

This section examines the risk management function of an insurer of mortgage loans. In particular, I discuss how an insurer can engage in active risk management through diversification, liability risk management, and asset risk management techniques. In the last part of the section, some new proposals are introduced. The purpose of these proposals is to generate discussion on their feasibility. They may also suggest a related or better idea to someone else.

In view of the micro aspects and regional influences on the default risk, it makes sense for a mortgage insurer to strive for a diversified portfolio of insurance contracts. Thus for example, it would not be prudent to concentrate on any one geographical region. The implications of this in the Canadian setting is that private insurers will tend to operate on a national scale. It is unlikely that if the private market develops or CMHC becomes privatized that there is scope for more than a handfull of private insurers writing this type of business. With a few suppliers, the possibilities for imperfect competition or collusion increase.

Another way to obtain diversification is to permit mortgage insurers to underwrite other lines of property casualty business. I am not aware of the exact legislation

in this area. I understand that property-casualty companies have shown little enthusiasm for entering into the mortgage loan default insurance market. This might change if premiums were allowed to be determined by market forces.

An insurer can also reduce risk by transferring a portion of its liabilities to another insurer or more commonly to a reinsurer. This is very common practice in both the life and general insurance markets. The reinsurance may be at the individual risk level. If a small life company receives a term insurance proposal with a sum assured of $20,000,000 it will normally pass on a substantial portion of the risk to a reinsurer by paying an appropriate premium. Reinsurance also takes place at the portfolio level. If the direct writer incurs claims above a certain predetermined level then the reinsurer pays the excess of such claims. Such contracts are known as excess of loss contracts and they serve as an upper bound on the direct writers individual losses. Reinsurance alters the risk-expected claims profile of an insurer in that it can reduce the direct writers risk exposure and of course his potential profit as well. The determination of excess loss premiums is a challenging technical exercise.

In the case of mortgage insurance, I understand that currently no reinsurance is available. It might be possible to form a pooling association of direct insurers and government agencies at the international level to arrange

reinsurance of this nature. Moreover the attendant currency risks would now enter the picture. It might be feasible for CMHC to act as a reinsurer. Since CMHC would be in a monopoly position here this would give it a powerful lever to control insurance premiums in the direct market.

A mortgage insurer could also take active steps to reduce its risk exposure by active asset management. In this connection the objectives of the insurer influence the decision. A private insurer owned by stockholders will attempt to attain a risk return profile, consistent with their shareholders expectations. The regulatory authorities will tend to insist on certain solvency standard being met. Managment will attempt to pursue a strategy which meets both of these objectives. This is what happens in the property-casualty fields. Apart from the paper by Brick and Thompson (1981) there seems to be little recent published material on the investment strategies of mortgage insurers. Their main conclusion after considering the performance of private insurers in the United States was

> "Thus a conservative investment policy based primarily on high quality, short to intermediate bond portfolios has considerate merit for mortgage insurers. Risk reduction stabilization of operating income and financial flexibility are significant benefits that accrue to both policyholders and stockholders."

In other branches of insurance the whole question of appropriate asset management strategies to ensure solvency has received considerable attention. For example in the life insurance area the asset management strategy pays attention to the nature and term of the associated liabilities. From this a strategy to protect or immunise the portfolio against interest rate shifts has evolved. The concept of immunisation was developed first in the United Kingdom by Redington (1952) but it has received widespread attention in North American as well (cf. Proceedings of the Canadian Institute of Actuaries, Vol. XII, No. 2, 1980-1981). With an immunised position and if assets are equal to liabilities then under a small change in interest rates, either up or down, the value of the liabilities will not exceed the value of the assets after the change. This concept is clearly related to the concept of hedging which is receiving enormous attention in the financial management area. Simply stated a hedge position involves taking a long position in one asset and a short position in another asset (or derivative asset) whose returns are correlated with the first so that the impact of price fluctuations is neutralised. For example if the owner of 100 call options to purchase a specific stock also sells short an appropriate amount of stock then his position is insulated against price changes. If the stock price goes up the gains on the option are offset by

losses on the short position in the stock and vice versa.

It is felt that this type of approach may provide assistance in the context of the asset selection and asset management problem of a mortgage insurer. Clearly what is called for is some asset whose value is correlated with the liabilities. The correlation need not be perfect and in fact given our discussion of the determinants of mortgage default it is unlikely that one exists and it is difficult to anticipate what it would be. A classic example of how NOT to proceed is furnished by the behaviour of some of the private mortgage insurers in the United States during the period leading up to the Great Depression. These insurers invested in the very mortgages they were insuring. When house prices collapsed this had the twin effect of increasing claims and reducing the value of their assets.

In the last decade a rich and diverse variety of new financial markets have opened and they provide the possibilities for new and imaginative ways of handling risks that were once thought as uninsurable. Individuals and corporations now have access to methods of hedging price risk in a variety of situations and new markets are opening all the time. It is suggested that either through existing markets or potentially available markets there is enormous scope for mortgage insurers to diminish their exposure to financial and macro type risk by strategic investment.

These new markets open up alternatives to individuals and corporations and expand the scope of risks that can be hedged. For example consider a wheat farmer. His welfare was improved by the introduction of crop insurance and hail insurance. One of his biggest risks is the price risk. It is now proposed to introduce options on wheat futures. This farmer will now be able to buy a put option on wheat futures and be fully protected against a drop in wheat prices. An exporter with a foreign exchange exposure can now hedge this risk by the use of foreign currency options. Insurance companies and pension funds are becoming increasingly active in managing their interest rate risk by actions in the futures and options markets.

How might these concepts be applied to the case of mortgage insurers so that they can reduce risk through active investment strategies? Brock and Thompson (1981) conclude that there is little justification for equity investments in mortgage insurers' portfolios. They suggest that foreclosurers are more likely to be widespread in times of economic adversity and unemployment conditions which are likely to coincide with a depressed stock market. Assuming this is the case the relationship can be exploited by the insurer. The purchase of long term put option in a stock market index or a stock market futures would give protection against this risk. Alternatively the insurer could write covered

calls against its own common stock portfolio or individual stocks. Currently call and put options on individual securities have a maximum term of 9 months and index futures have a somewhat longer time to maturity. This line of reasoning can lead to an option position in the stock of an individual company or group of companies whose fortunes are closely allied with a particular region. For example, buying a put option or selling a call option on the stock of a forestry company would give some protection against default risk caused by a decline in that company's fortunes resulting in heavy unemployment in the region. Another technique would be to take an appropriate option position on futures in the lumber market. These examples are meant only to be illustrative.

It has been noted that a recession in the residential real estate market can give rise to an increased incidence of defaults. In these circumstances, it seems that mortgage insurers would welcome the introduction of new financial instruments which enable them to hedge this risk. One such possibility might be futures contracts written on residential real estate. If in addition options were available on these futures contracts, there would be increased scope for a variety of hedging and risk reduction strategies. Hopefully other investors would find such contracts of interest as well.

There are obvious practical problems with the construction of such contracts and no doubt other problems that I have not thought of. It would be necessary to have the futures contract written on a standardised unit. In addition, it should not be possible for any one individual to affect the price or manipulate the index. There are published figures on prices of representative houses prepared by Royal Trust for the major residential areas in Canada. No doubt CMHC itself has similar data. From an examination of these data sources, it should be possible to see if a suitable index could be obtained. The index should be clearly defined, unambiguous and impervious to manipulation. Although regional indices could have considerable utility, they might be more amenable to manipulation. Currently in the United States, there are proposals to introduce options on cattle futures. The underlying index that has been suggested is to be composed of a weighted average of prices in a set of recognized markets. Perhaps some type of averaging along those lines would lead to a suitable futures contract for Canadian residential real estate. The weighting factors could be proportional to the relative sizes of the various real estate markets. Assuming such instruments existed, the mortgage insurer could use them in at least two ways. First, the put option prices would be helpful in setting the premiums for mortgage insurance.

Second, these instruments would open up new possibilities for active risk management and hedging on the asset side. The purchase of put options would give protection against an increase in liabilities arising from defaults stemming from a sudden decline in house prices.

There is quite an emerging literature on the pricing of options, the relationship between options and futures and hedging applications. Black (1976) gives a simple formula for the price of an option in a futures contract. Although he assumes a constant interest rate, the formula can be generated to incorporate stochastic interest rates. Moriarty, Phillips and Tosini (1981) discuss hedging with both futures and options contracts and point out some of the key differences. It is beyond the scope of this report to pursue this interesting topic further.

To summarize the present section, the main idea is that active risk management can be a useful tool in risk reduction. The main points covered were:

- The liability risk can be reduced by geographical diversification. This implies Canada should not have more than a handful of mortgage insurers.
- The liability risk can be reduced by transferring part of it to a reinsurer. There may be an innovative rate for CMHC in acting as a reinsurer.

- There are possibilities for hedging the liability risk through appropriate active asset management techniques. Existing and potentially available financial instruments offer new techniques for handling the risks faced by mortgage insurers.

- Some particular suggestions for active asset risk management were made in the context of a mortgage insurer. Suggestions were made concerning the types of new financial instruments that would be helpful in this connection. It may be that CMHC can play an innovative role here as well.

## 6. Roles of Private and Public Mortgage Loan Insurance. Analysis and Recommendations

In this section, I will cover some topics that bear on the operation of private and public insurers in the mortgage loan insurance area. The Economic Council of Canada in its report entitled "Intervention and Efficiency" recommended that CMHC withdraw from the direct insurance area and offer mortgage reinsurance instead. This report also recommended that CMHC encourage the entry of private insurers into the direct-insurance market. Private insurers will only do this if they can obtain a return commensurate with the risks involved. There are in todays conditions some factors that would inhibit the further growth of a private market. I will comment on some of these. In recent years the co-existence of both a large government insurer, CMHC, and private insurers appears to have caused some difficulties. CMHC has a mandate to fulfil certain social objectives and the pursuit of those objectives can interfere with its insurance function as a mortgage loan insurer.

The providers of equity capital will require a return commensurate with the risk involved. The heavy losses suffered by both CMHC and MICC in recent years will not tend to favour the enlargement of the private insurance market

in this field. In recent years the earnings per share on the common shares of MICC were

| Year* | Earnings/Share $ |
|---|---|
| 1979 | 1.62 |
| 1980 | 0.97 |
| 1981 | 0.78 |
| 1982 | (0.77) |
| 1983 | (8.55) |

[*Source: MICC Annual Report 1983.]

It appears as if one of the reasons for the recent heavy losses is that MICC was unable to adjust its premiums upward in a market where its only competitor, CMHC, was charging an inadequate premium. No doubt CMHC also realised its own premiums were inadequate but it does not have the flexibility of a private corporation. In addition CMHC has an implicit government guarantee which is not usually available to a private corporation. It is not necessary here to examine all the reasons why premiums were left unchanged. The point is that potential private insurers contemplating entering this business will be conditioned heavily by recent experience. They will note that the private insurer had little power to reduce or mitigate very heavy losses. On the other hand, if we had experienced instead a period with substantial profits, it is not inconceivable that there would have been pressure from

different quarters to reduce premiums. The conclusions from this line of reasoning is that in times of adverse results it is difficult to reduce losses, but 'excess' profits may be trimmed. These arguments are, I admit, somewhat speculative, but there must be reasons why private insurers have not shown a keener interest in this market.

At the moment in Canada, both life insurers and property and casualty companies are interested in diversifying their range of activities. Some of the reasons for their lack of interest in the mortgage loan insurance area may be due to regulatory constraints. However, the main reason is simply that they view this as an unprofitable line of business. The recent experience of MICC and CMHC is likely to strengthen this viewpoint. They may feel that the possibility of government interference in this market adds another dimension of risk to a business which is already risky enough.

On the other hand, if CMHC were to withdraw from the market altogether, it is far from clear that a competitive market would result. The managers of a private corporation have as one of their main objectives the maximisation of shareholder wealth. If one private insurer were all that remained, the pressures towards monopolistic pricing would be very strong. However, if this one insurer were seen to

be earning monopoly profits, there would be incentives for other insurers to enter the market and compete on a price basis. The nature of the mortgage insurance business is such that it is most likely an oligopoly will result with strong incentives for collusion concerning price setting. In this connection it would be of interest to examine the structure of the market in the United States. Swan (1982) refers to a study carried out by Peat, Marwick, Mitchell and Co. in 1980 on the competitiveness of the market in the United States. I suggest that an analysis of the U.S. market in terms of institutional structure, risk assessment, contract design, premium levels and administrative procedures should prove helpful in evaluating the Canadian situation. There are of course important differences but the comparison can take these into account as well.

In order to stimulate investor confidence regarding the prospects of private insurers, specific efforts must be made. These might include but would not be restricted to:

(i) Lifting restrictions on premium rates. If CMHC continues to charge an uneconomic premium rate, a private insurer is forced to do likewise. Hence if CMHC remains in business in this field its premium rates must be adequate.

(ii) The insurer should have the freedom to vary the premium rates according to risk class. (Recall however possible impact of human rights legislation.)

(iii) More efficient contract designs should be introduced to induce appropriate incentives. Some general aspects of such designs were discussed earlier.

(iv) Liability risk management should include appropriate diversification and risk-sharing through reinsurance. Risk management is also feasible by following appropriate investment strategies.

Under this scenario, the activities of CMHC might include:

(A) Promotion of a market for reinsurance. CMHC should aim to have its reinsurance operation profitable. Some form of experience rating may be desirable. Premiums can be controlled to some extent in the direct market in this way.

(B) CMHC may have a role to play in introducing new financial instruments which could be useful in the hedging operations of private insurers.

(C) CMHC will still have a role in meeting social objectives of government policy. For example, unserviced borrowers could be lent money directly by CMHC.

Points (i) to (iv) constitute a summary not just of this section but also of the entire report. They represent my thoughts in the steps needed to stimulate a private market. In the same way, points (A), (B) and (C) indicate the possible role of CMHC. It is emphasized that this represents but one scenario. However, it is hoped that it will provide a useful basis for generating discussion and may stimulate others to improve upon it or come up with alternative scenarios.

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